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Commentary

Comments on the California Studies

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I became interested in asbestos in drinking water supplies in the spring of 1973 when Mr. Jack Murchio, our electron microscopist, pointed out that a number of San Francisco Bay Area reservoirs were situated on geologic formations that are known to contain asbestos, i.e., serpentine rock. Thus we set out to examine the raw drinking water associated with these reservoirs for the presence of asbestiform fibers. This required the development and refinement of a method for the determination of concentration, enumeration, and identification of fibers in water using electron microscopy. The results of our preliminary investigations indicated that fiber counts as high as 2×10^8 fibers/L were present. These results were published in September 1974 (*1*). To my knowledge, this was one of the first reports of the presence of asbestos fibers in drinking water associated with natural geologic formations rather than with asbestos mining or other industrial activities.

The potential public health problem associated with asbestos in water supplies, particularly in light of the 1974 reports from Duluth, MN, seemed obvious. An epidemiologic study appeared feasible, since the San Francisco Bay Area was serviced by a number of water supplies, some from asbestos-rich geologic formations. Tumor morbidity data for the geographic area involved was available through the San Francisco Bay Area Resource for Tumor Epidemiology. Our epidemiologic study was funded in 1976 by the EPA Health Effects Laboratory. Dr. Marty Kanarek (a doctoral student at the time) was the project manager and Mr. Paul Conforti was assigned as project statistician.

The resultant study was subject to all the problems of such projects. The most time-consuming task was to develop water supply information as it related to the 1970 census tracts of the involved counties and to determine whether or not such information reflected 20–30 years of past history. Among the problems we recognized were the insensitivity of the asbestos assay method, the incomplete employment history available from the tumor registry, the lack of smoking and alcohol consumption data, and the problem of population mobility.

As is well known, the final result of our study (*2*) showed a statistically significant correlation between asbestos fiber concentration in drinking water and cancer incidence, particularly in organs of the digestive tract. We were very cautious to claim only a statistical relationship and not one of direct cause and effect. One troublesome result was a statistically significant negative correlation between uterine cancer and asbestos fiber concentration.

The statistical methods used in our study were relatively simple and straightforward. Since the publication of our results, Dr. M. Tarter, at my request, has rigorously reanalyzed all of our data to determine the reality of the observed correlation. The results of this further analysis have generally reconfirmed our earlier observations. The negative correlation between asbestos level and uterine cancer is most likely a statistical artifact due to the method of residual analysis performed in the original study.

A number of critics raised the question of whether population density might be a major cause of the observed positive correlation. As Dr. Tarter reported, our recent analysis of the effect of population density shows no impact on the correlation between asbestos concentration and tumor incidence. However, in the process of this latter analysis, it was seen that the data from San Francisco City and County *per se* has a major effect upon the correlation that is not related to population density. We are presently referring to this effect as the "San Francisco phenomenon." We are now attempting to describe this phenomenon in more detail and to determine if it is independent of asbestos dose.

If upon further study the relationship between

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asbestos concentration in drinking water and cancer incidence appears to be independent of the San Francisco phenomenon, more work will be needed to better estimate if asbestos in drinking water causes cancer in those exposed. A well-conceived case-control study would be the most logical next step.

The views and policies presented by the author in this commentary do not necessarily reflect those of the U.S. Environmental Protection Agency. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

REFERENCES

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